MODIS Team Meeting Minutes

Minutes of the MODIS Team Meeting held on Tuesday November 30, 1993.

Action Items:

70. Evaluate the thermal design of the Schaeffer Magnetics' motor/encoder. Assigned to Daelemans 8/31/93. Due 10/15/93

73. Complete the MODIS brochure and released for printing. Assigned to Bauernschub 10/18/93. Due 11/15/93.

74. Prepare and submit a Configuration Change Request which revises the definition and impact of levels of software criticality for the MODIS Software Management Requirements Document. Assigned to Anderson 10/26/93. Due 12/ 1/93

75. Determine if the four electronic module boxes can be individually thermal tested in air, or must the thermal testing be done in a vacuum. Assigned to Silva 10/26/93. Due 11/ 9/93

76. Provide a schedule of the SBRC internal CDRs. Assigned to Bauernschub 10/27/93. Due 11/23/93

77. Transfer review and approval of Class II changes to David Jones. Assigned to Anderson 11/ 2/93. Due 11/16/93

78. Recommend details of agreement with SBRC for GSFC access to near-real-time test data. Assigned to Montgomery 11/16/93. Due 12/ 7/93.

79. Consider advisability of bringing bad Readout ICs to GSFC for electrical tests or destructive physical analysis. Assigned to Bob Martineau 11/23/93. Due 12/ 7/93

80. Determine what post-Software Acceptance Review (SWAR) tests need to be done to prepare MODIS for operations during the early on-orbit instrument checkout using macros. This involves determining the following:

1.) Who at SBRC is responsible for generating and testing these macros?
2.) When will this work on these macros be started?
3.) When will these macros be defined?
4.) When will these macros be tested?

Assigned to Guenther 11/16/93. Due 12/7/93.

81. Determine use of on-board calibrators during testing and on-orbit. This is a lifetime issue involving motors, diffuser degradation due to exposure to sunlight, and use of calibration bulbs. Assigned to Guenther 11/23/93. Due 12/14/93.

The following items were distributed:

1) Weekly Status Report #115

2) SBRC Memos submission from week #107

3) Minutes of the last team meeting

Attendees:

√	Dick Weber		Bruce Guenther		June Tveekrem
√	John Bauernschub	√	George Daelemans		Bob Martineau
√	Rosemary Vail		John Barker		Bob Silva
	Lisa Shears		Joann Harnden		Ken Brown
√	Mike Roberto	√	Patricia Weir		Robert Kiwak
√	Nelson Ferragut		Mitch Davis	√	Harvey Safren
√	Gene Waluschka		Jack Ellis	√	Ed Knight
	Kate Forrest	√	Ken Anderson	√	Harry Montgomery
	Bill Barnes		Rick Sabatino		Marvin Maxwell
	Les Thompson	√	Cherie Congedo	√	Bill Mocarsky

Team Meeting and Other Topics November 30, 1993

General

Gary Barnett and Gerry Hyde have retired from SBRC. Oscar Weinstein is making a good recovery at home after having surgery. The Quarterly Management Review will be held at GSFC on December 16, 1993. The Tinsley CDR on the MODIS Ground Based Calibrator (MGBC) will be held in January.

A VHS video showing animated deformations of Cherie Congedo's model of the radiant cooler was sent to SBRC on November 23rd.

Electronics Box Testing in Air

Dick Julian was informed on 1 December that GSFC will likely want to have the electronics boxes tested in vacuum. There was a conference call later in the day involving Dick Julian, Rod Durham, and Mike Roberto.

SBRC's concern about testing the electronics boxes in thermal vacuum is as follows:

1) There are many hundreds of wires which would require vacuum feedthrus with the possible pickup of noise.

2) A significant amount of test equipment which can now be set up in ambient conditions would have to be set up inside the thermal vacuum chamber and would therefore have to thermal vacuum compatible.

Dick's preference would be to do testing of the electronics boxes separately in air (in an oven which would be hot enough to assure components would not run hotter in thermal vacuum). I mentioned the concern of thermal engineers and Code 300 about having components operating at temperatures other than those which they would experience in thermal vacuum, particularly analog circuits.

Dick offered that the SAM and FAM could be tested in thermal vacuum. Significant analog circuits are in these boxes. All detector signals are digitized in these boxes. However, this also would involve developing thermal vacuum test equipment for the SAM and FAM. The MEM is primarily digital with some 8 bit and 12 bit analog housekeeping signals.

The GSFC MODIS team will discuss this and get back to SBRC.

Vibration Testing Telecon

A telecon on vibration was held with SBRC on November 29, 1993. At SBRC, the telecon included Jack Brooks and Tom Wolverton. Tom Venator, Nelson Ferragut, Ken Anderson, Rosemary Vail, and Mike Roberto were at GSFC. There were three topics:

1) GIIS shock spectrum (page 3-15)

SBRC designed to proof loads and random. This test will be deferred to spacecraft level. Tom Venator felt the SBRC design criteria were okay. To get actual values for the normalized shock spectrum, read shock value from Table 3-3 on page 3-14 of the GIIS. For MODIS, the peak shock value is 580 G's.

A few reasons for deferring shock tests to the spacecraft level have been pointed out by Nelson Ferragut:

a) A shock test on a shaker can imply very high loads at low frequencies because the shaker starts at a low frequency.

b) Components are often quite isolated from the shock.

c) The GISS shock spectrum starts at 100 Hz, while the fundamental frequency of MODIS is about 50 Hz.

2) Cost reduction option number 9A (version 11/3/93 from SBRC) This option recommends the modal survey of the EM be replaced with a sine survey.

Hughes never did a modal test on a structure that small. Usually, a modal test is done on the entire spacecraft. SBRC is not happy about stingers and the cost of the modal survey. SBRC does a low level sine survey with accelerometers and compares amplitudes with predictions.

Tom Venator felt SBRC should be able to get 2 or 3 modes; they may need 20 or 30 accelerometer channels, maybe less. The frequencies and primary mode shapes need to be characterized. The S/C does not need every local mode analyzed. Characterize modes below 70 Hz, but not those with low mass participation. Tom pointed out that the information required by the modal survey could be obtained by a properly instrumented sine survey.

According to Nelson, a modal survey would take about one week. A sine sweep of three axes can be performed in one day.

The required information for NASTRAN model verification is found in paragraph 60.1.5 of the GIIS, shown below:

60.1.5 NASTRAN Model Verification (Page E-4 GIIS)

If either analysis or a frequency verification test show any significant mode below 70 Hz, these modes shall be verified through a modal survey. The analytical frequency predictions shall agree with dynamic test data within 5 percent for the fundamental mode and to within ten percent for all remaining significant modes to 70 Hz. A cross orthogonality (spelling) check between test and analytical mode shapes should have diagonal terms above .9 and off diagonal terms below .1 for all significant modes up to 70 Hz.

3) Sine burst test for graphite epoxy structure

The test actually went above 15g. There was a possible question about amplification factors between the base and the component. The aft optics platform by itself has a fundamental frequency of 120 Hz.

STOP Presentation

A Structural Thermal Optical (STOP) meeting was held on November 29th to present the STOP results to members of the MODIS science and management teams. Cherie Congedo presented the STOP results.

Other attendees included Dan Powers, Qian Gong, Bill Case, Bill Barnes, Ed Knight, Les Thompson, Ken Anderson, George Daelemans, Dick Weber, Gene Waluschka, and Mike Roberto.

Results indicate the pointing and registration requirements will not be met in a number of cases if the instrument is aligned under ambient conditions on the ground and launched. Hot and cold cases were run along with three calibrator power cases. The hot and cold cases were averages of several points in the orbits at end of life and beginning of life. Note: The full error budgets for pointing and registration apply separately along each axis. Scan and track errors should not be Root Sum Squared (RSS ed).

The most significant misalignment is caused by the initial cool down of the radiant cooler. The STOP results may be able to be used to predict the misalignment necessary during alignment in ambient conditions in order to bring the instrument into alignment after cool down in a thermal vacuum chamber (note: ambient alignment will involve conductive cooling of the cold focal planes using the Bench Test Cooler).

Additional analysis will be performed, as necessary, to determine if the following assumptions are correct:

1) the variation in temperature distributions during an orbit are not significant
2) rotations of each focal plane does not cause significant misalignment within the focal plane
3) there is sufficient repeatability of alignment of the radiant cooler after temperature cycling after there has been a vibration of the cooler and initial temperature cycle.
4) Deformations of the surfaces of optical components and changes in index of refraction are not significant.
5) MTF requirements are met.

MODIS will be aligned to minimize displacements due to 1 G release. The planned orientation is for the +X axis to point toward the ceiling. The Earth aperture will be sideways and the instrument will be lying on the side with no doors. Preliminary indications are that realignment of MODIS after thermal vacuum checking of alignment will involve significant disassembly. It is hoped that the STOP results can be used to minimize any realignments.

Convergence

An article (#16363) in Aerospace Daily, dated November 10, indicates the Congress may order the White House Office of Science and Technology Policy (OSTP) to come up with a plan to combine DOD's Defense Meteorological Satellite Program (DMSP), the NOAA Polar-orbiting weather satellite program and NASA's EOS PM program.

Transient Response Predictions

Tom Pagano has written a memo on Crosstalk and Along Track Ghosting on Transient Response (M03250), dated November 15, 1993. In this memo, the transient response includes the sum of ghosting and detector crosstalk. The transient response spec for MODIS is written "... when the IFOV scans across a steep gradient..." The 0.5% spec applies within 2 km of the radiance step change in the scan direction. Tom's results predict along scan transient responses of about 0.6% to 1.1% for about 14 bands, about 1.2% for band #13, and about 2.3% for band # 18.

Tom's transient response predictions were presented to the MODIS science team by Bill Barnes in mid November. There are no plans to try to develop a new detector technology to reduce detector crosstalk. The goal is to do the best that can be done with existing technology. However, additional analysis should be done to show the additional distance from a cloud which is needed for each band to bring the transient response into spec.

Impact of MODIS 120 VDC power on During Launch

There was a discussion in mid November with Gary Barnett on launching with MODIS powered or unpowered. Gary prepared a memo dated November 18 on the subject (M03267). Launching in the powered condition requires:

1) Input power connectors sealed between the pins, but each pin freely vents to space.

2) 120 VDC relays hermetic

3) Exposed traces or wires carrying 120 VDC vacuum potted or conformal coated For launching in the unpowered condition, the following applies:

a) Electronics modules and other areas where the 120 VDC is distributed depressurize to less than 0.001 Torr within 18 hours of launch (assumes launch at 10 degrees C and survival power is not needed for at least 24 hours)

b) Any areas which can not meet #1 need to comply to requirments for launching in the powered mode.

PC Detector Cracking and Detector Crosstalk Action Items

There was a discussion with Bob Martineau to go over the status of SBRC's work on the action items which resulted from the meetings at SBRC on October 13 and 14 on the PC detector cracking problem and the measurements of detector crosstalk. The status of the action items as of the dry run for the CDR (November 8 - 10) was reviewed. Bob and I believe the following should be completed:

1) Provide closure date for all action items.

2) AI-3: Perform stress analysis for S/MWIR and LWIR FPA's in all test and flight configurations.

3) AI-8: Temperature cycles of the PC detector/motherboard assembly could unnecessarily overstress the detector.

4) AI-10: Do static modeling to determine maximum stress on FPA when the MARS bar hangs from the JBar when loading test dewar.

5) AI-12: Detector crosstalk tests need to include at least two flux levels. Assure the results make sense.

6) AI-13: This was developed into 5 questions for Don Thornton. Assure laser spot scan crosstalk measurements were taken illuminating two different pixels on the same array (part of question 1) and crosstalk measurements were taken for different flux levels (part of question 4).

It is important to quantify the stresses each detector array is subjected to and to understand the maximum stress level each detector array can withstand so sufficient margins can be assured.

Adjustable MODIS Scan Rate

One item resulting from the EOS AM Spacecraft PDR was consideration of an on-orbit adjustable scan rate for MODIS. The recommendation suggested the scan rate change of the order of one percent could reduce interaction with solar array modes by an order of magnitude. The plan by SBRC is to balance the scan mirror so that the scan rate will no longer be a problem. The assumption is that the static and dynamic imbalance of the scan mirror will remain small over the five year mission. At this time, the adjustable MODIS scan rate is considered a dead issue.

For information purposes, the impact of a commandable scan rate (up to one percent change) on the scan mirror controller was discussed with Dick Julian on December 1st. The change would not be conceptually difficult. A counter would become reprogrammable. A new serial command would be needed. A couple

of cards would be changed, with a new layout for the scan controller card. However, a couple of man months effort would be required for the change. Additional time would be required by systems engineering to evaluate the various impacts of the change, such as gap between scans, signal to noise, data rate, documentation, etc. If the one percent scan rate change was not sufficient, then the impact would become even greater.

Carlsbad Capabilities

In a conversation with Rod Durham on December 1st, he mentioned the extent of the work done by the Carlsbad facility is PV silicon detectors in the visible and near infrared and the silicon readouts (for MODIS, Carlsbad is doing the detector readouts for the PV detectors and VIS and NIR silicon detectors).

Calibration Sequences

John Mehrten has sent to GSFC updates on the SRCA radiometric and spatial calibration sequences and the SDSM calibration sequence. Expect changes in these sequences.

Systems Engineering and Calibration Telecon

The regular weekly telecon was held on November 29th. Gerry Hyde was present to say good bye. Tom Pagano mentioned that APART or ASAP will be used to check for stray light thru the solar diffuser or SDSM ports.

Mike Roberto

December 2, 1993